

Lean Construction in international EPC/Turnkey Projects

Concept, implementation and results

Lean Group GmbH

Theo Herzog, Frankfurt am Main, 11.05.2021

Overview of main consulting areas



Construction and Maintenance



Logistic and Supply Chain



Engineering and Procurement



Operation and Service



Project Management



Organisation

Overview exemplarily EPC projects



Site: Sector: Year: Nischnekamsk, RU Olefin plant 2020



Site: Sector: Year: Cordemais, FR power station (coal) 2016



Site: Sector: Year: Tricastin, FR Nucl. power station 2016



Site: Sector: Year: Berre-l'Étang, FR Chemistry 2016



Site: Sector: Year: Fortescue, AU Natural gas 2013



Site: Convent, US Sector: Hydrogen Year: 2020



Site: Sellafield, UK
Sector: Nucl. power station
Year: 2016



Site: Kårstø, NO Sector: Natural gas Year: 2016



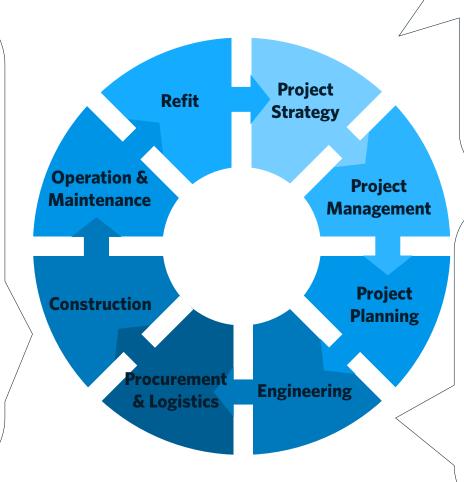
Site: Turku, FI
Sector: Shipbuilding
Year: 2015



Site: Troll gas and oil, NO
Sector: Gas and Oil
Year: 2015

Extract of deep-specialized topics for the project industry

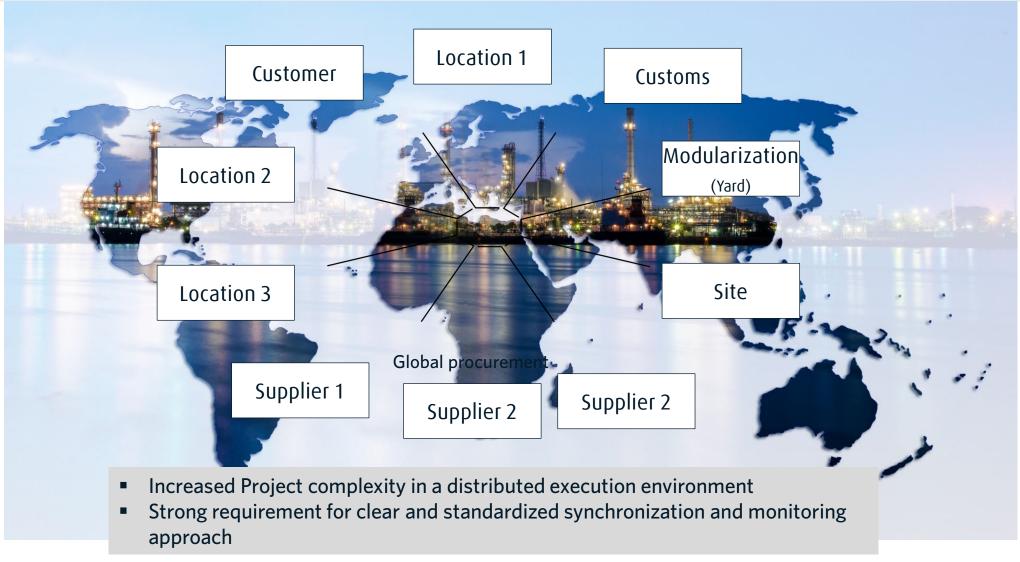
- Definition of a production system and implementation of a production Takt
- Significant reduction of man hours and lead time in manufacturing and construction
- Development of a lean plant layout and assembly lines incl. logistics and investment plan if required
- Implementing of a performance indicator for prototype industry
- Increase of prefabrication and modularization of building units



- Development of execution strategies and structure
- Rebuilding planning approach based on lean principles
- Implementation of hybrid project management (Lean and Agile)
- Set-up of **real-time multi-level KPI** and reporting system
- Efficiency increase and reduction of engineering hours for prototype projects
- Development of a platform and modularization concept
- Implement standard design criteria and procedures to reduce non-quality costs
- Standardization and cost-partanalysis to reduce purchasing costs

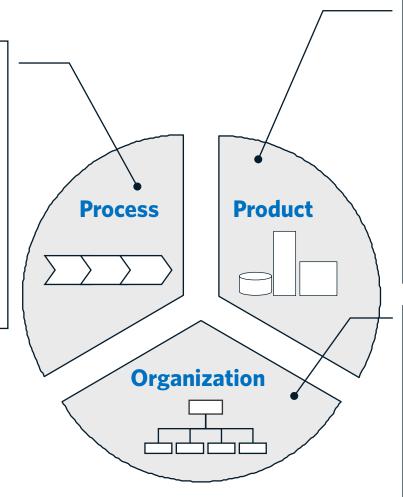
I FAN GROUP

Global execution scheme with project execution challenges



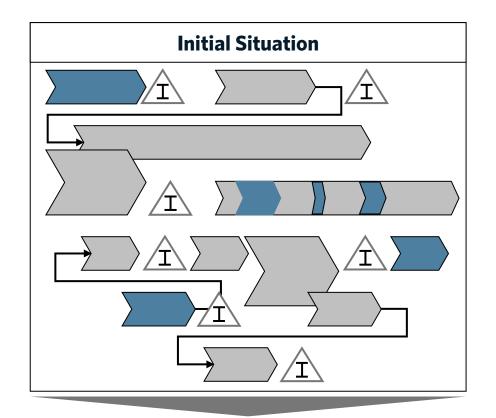
Focus is the continuous elimination of waste in process, product and organization

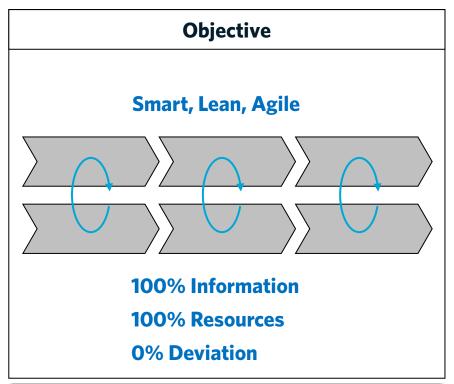
- Unsynchronized process
- Iterations
- Waiting for controls and decisions
- Repeated faults
- Parallel concepts
- Over documentation
- Complex flow of information
- Rework/errors/scrap



- Excessive product specifications
- Too many functions
- Too many and needless variants
- Excessive norms and tolerance
- Unnecessary changes/late engineering
- Too high material requirements
- Complex structures
- Unclear responsibilities
- Unused employee potential
- Missing qualification
- Locations not structured
- Distributed development

Vision: Synchronized execution process for all involved functions including the customer following the JIT-principle





- Current process is complex, gates are flexible and not measurable
- Lead time are long, execution concepts are not integrated

Synchronized execution process for all involved functions including the customer

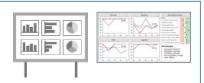
Project Execution System for EPC multi-project and -site operations

Cross-project

Portfolio and **Growth Strategy**

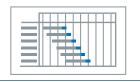
Project Execution Strategy

Multi-project control and reporting



Project Execution

Takted tendering and awarding



Project specific

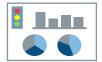
Engineering

Procurement

Construction

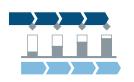
End-to-End-Execution Framework





Lean Design & Engineering





Takt planning and control



Logistics



Modularization

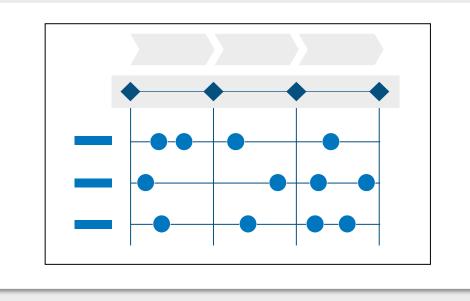


Supplier Cost Reduction



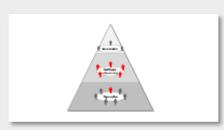
End-to-End-Execution Framework Four elements support the high-performance project management process

PROCESS MAP



- Effective target process with focus on major activities
- Synchronized interfaces and workflows
- Clear tasks and responsibilities
- Milestones as quality gates

ORGANIZATION



- Defined structure of decisionmaking bodies and escalation path
- Embedded process improvement

CONTROL & REPORTING



- Continuous progress measurement
- Fast response
- Transparency on status

STANDARDS & TOOLS



 Efficiency through binding standards and tools per key point

Objectives of a Hyprid Project Management approach

Execution Principles



Collaboration and individual interactions with a standardized approach



Dividing the project scope into blocs, takt activities and sprints



Improved synchronization and transparency



Execution of the activities on **committed due dates**



External and internal customer collaboration focused on valueadding activities



Short-cycle review of completion and performance

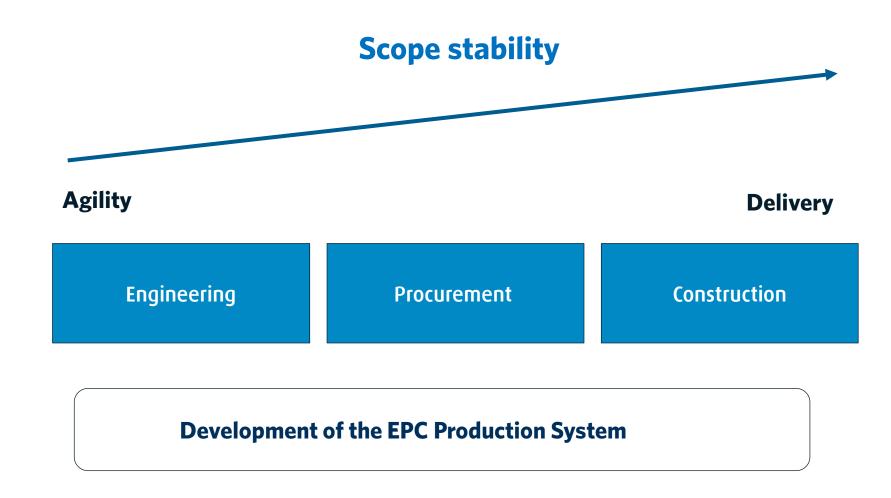


Fast responding to change requests over following a rigid plan



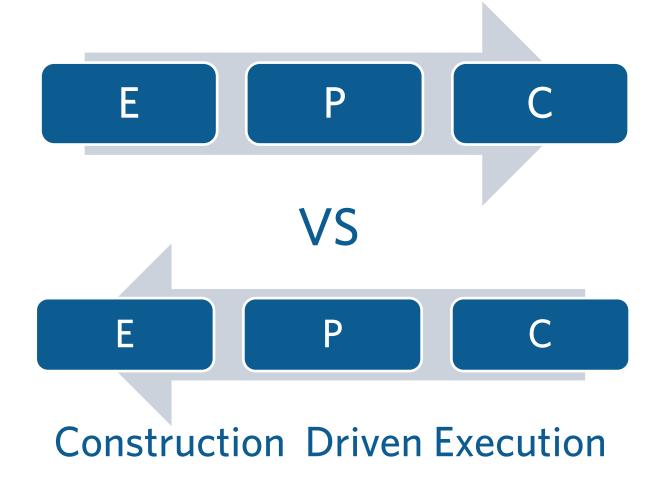
Continuous repeat of planning and execution

The execution methodology has to be adapted through the different phases of a project

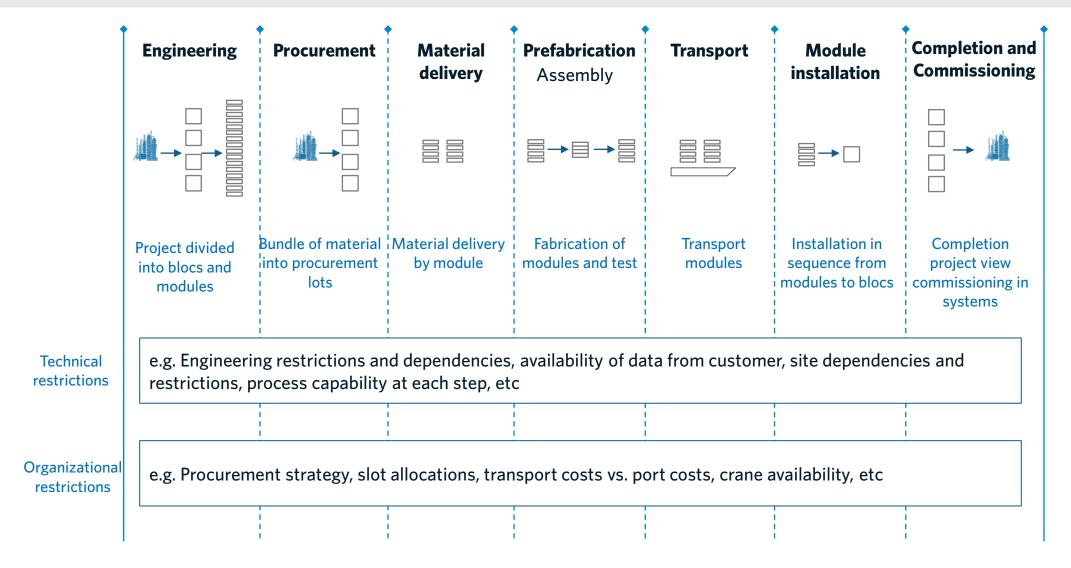


EPC Execution Strategies

Engineering & Procurement Driven Execution



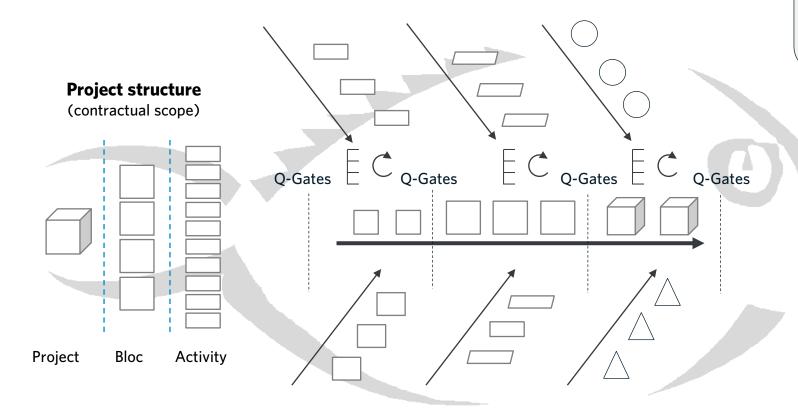
Technical and organizational restrictions must be considered upfront



Schematic view of a Just-in-sequence EPC Execution Model

Just-in-sequence EPC Execution Model

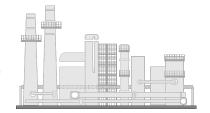
(100% Information, 100% Material, 0% Deviation)



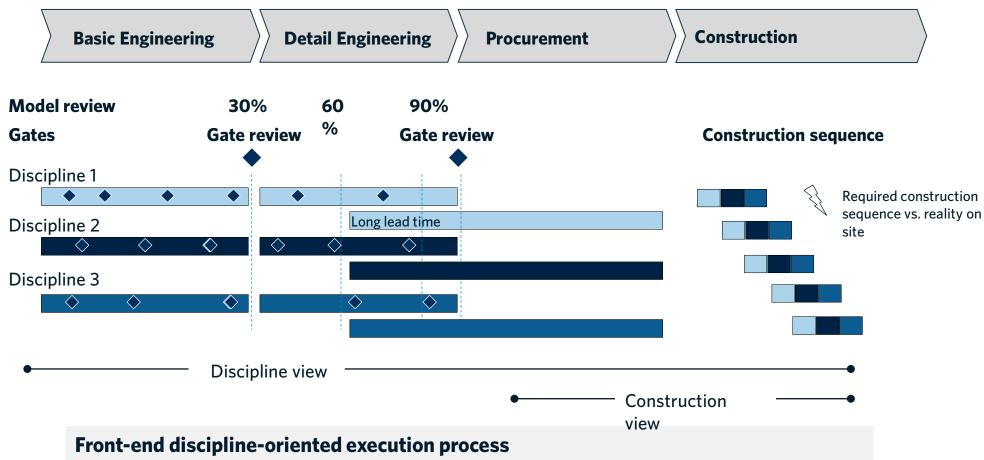
Applied principles

- Takt
- Flow
- Pull
- 0-Deviation
- Reactivity

Installation with CA and Modules



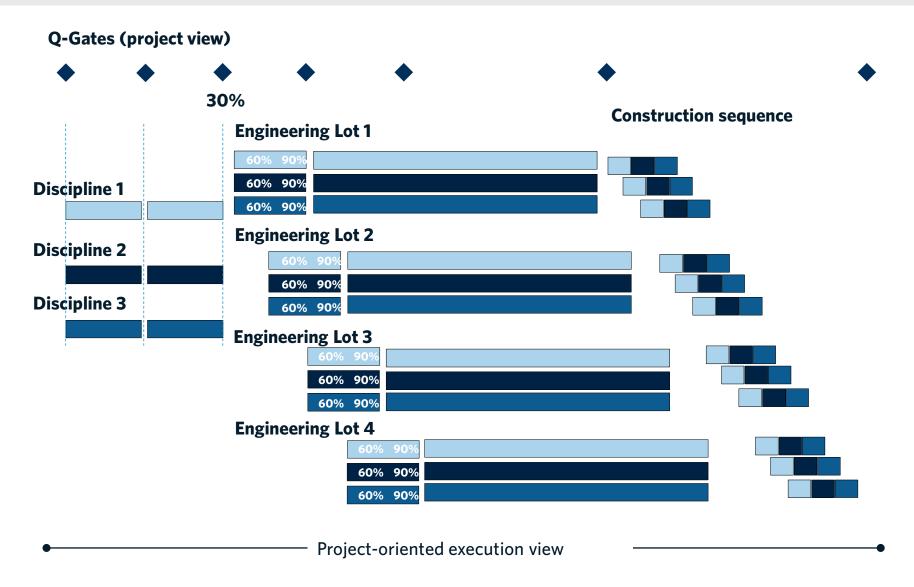
Many projects follow a discipline-oriented execution systematic with difficulties in providing the required information for the construction sequence



- Difficulties to match construction requirements
- Quality-Gates are for disciplines lack of synchronization and priorities
- General long lead times due to stick-built approach

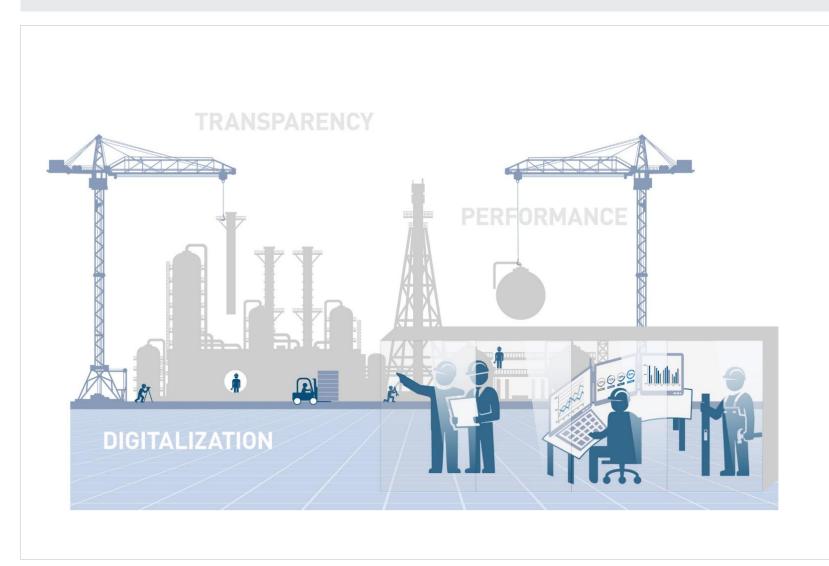
LEAN **GROUP**

The approach is a reduction of engineering units and other lot sizes to define the chronological order which leads to overall shorter lead times



TPC - Takt planning and control

Synchronization of all design and construction activities with lean and agile principles





Construction strategy



Cloud based collaboration plattform



Standard processes



Flow and Takt planning



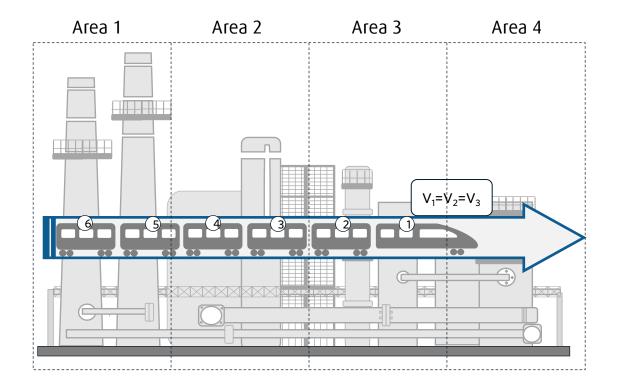
Live update of schedule



3D Model connected

PES - Project Execution Strategy

Lean principles applied for the project-oriented EPC construction industry



- (1) Piling
- (2) Civil
- ③ Piping Design
- (4) Structural Steel
- **5** Rotating Equipment
- 6 Quality

Flow

Continuous uninterrupted workflow of all disciplines

Takt

Adjustment and harmonization from capacities

Pull

Timely pulling of materials and resources

Zero Defects

Standardization and stabilization of all processes

Takt Planning and Control principles

1

Takt Planning

- Division of the project into sections, as well as their scheduling to ensure the most efficient and timely execution process
- Planning of activities in consideration of sequence, quantity, quality and milestones in form of a 12-week look-ahead
- Preparation of activity cards with deliverables based on defined data sources and setup on Takt Planning Board

2

Takt Control

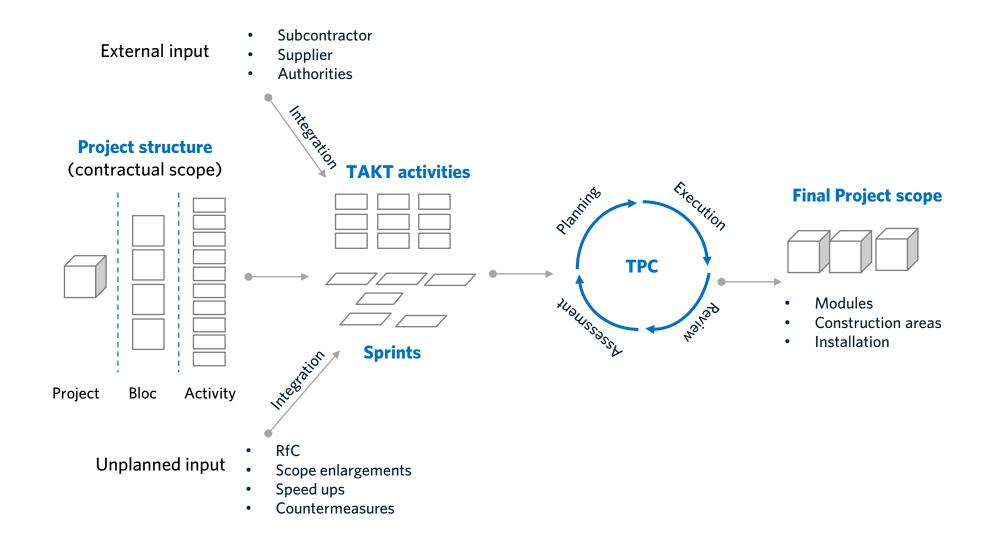
- Short-term control of the project status and on the definition of the appropriate countermeasures when necessary to ensure the fulfillment of the planned engineering takt
- Weekly control of activities planned for the previous week based on the disciplines' activity cards
- Review of the upcoming activities planned for the next 2 weeks and removal of recognized constraints

3

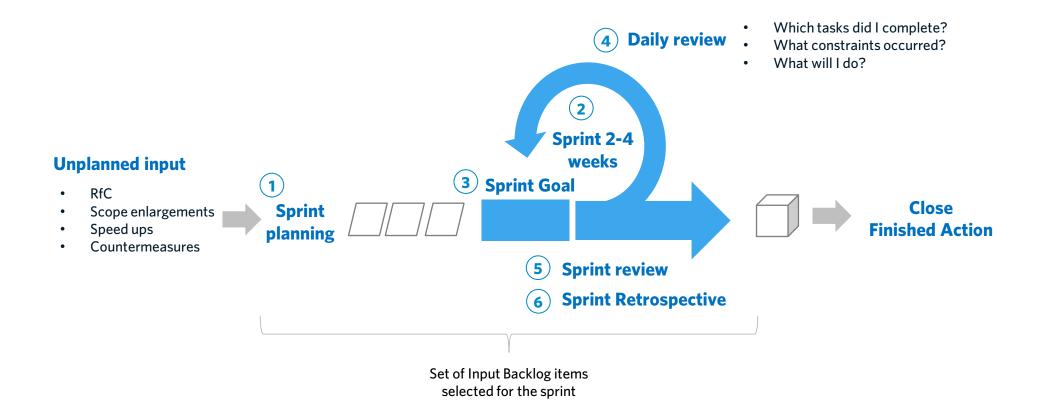
Performance Measurement

- Definition and utilization of KPI -Key Performance Indicators enhances the transparency and highlights deviations between the actual and the planned status
- Measure the extend to which the leads commitments were fulfilled
- Assess the planning system and realize which activities were completed as compared to the schedule

All deliverables and requiremens to be organized into TAKT activities and sprints - followed up in TAKT meetings

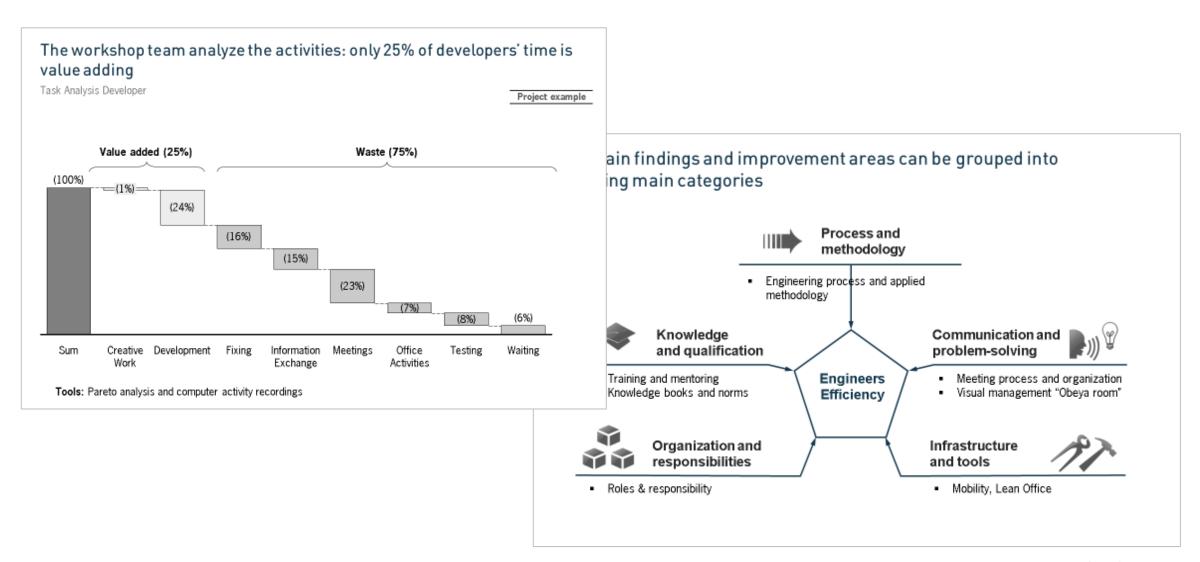


Overview for sprint workflow for unplanned jobs



EE - Engineering Efficiency

Waste reduction and productivity increase for knowledge worker (engineers)



Our focus is the improvement of the main operational key performance indicator



Productivity

- Project execution performance increase
- Productivity increase (direct and indirect areas)
- Overall equipment effectiveness increase
- Operating cost reduction (production, logistics and supply chain)
- Product cost optimization and reduction
- Non-Quality cost reduction



Agility

- Lead time reduction (in engineering, purchasing and construction)
- Inventory reduction and cash flow optimization
- Changeover shortening



Sustainability

- Supply chain global footprint
- Waste and scrap rate reduction
- Energy efficiency (e.g. Pressure air consumption reduction



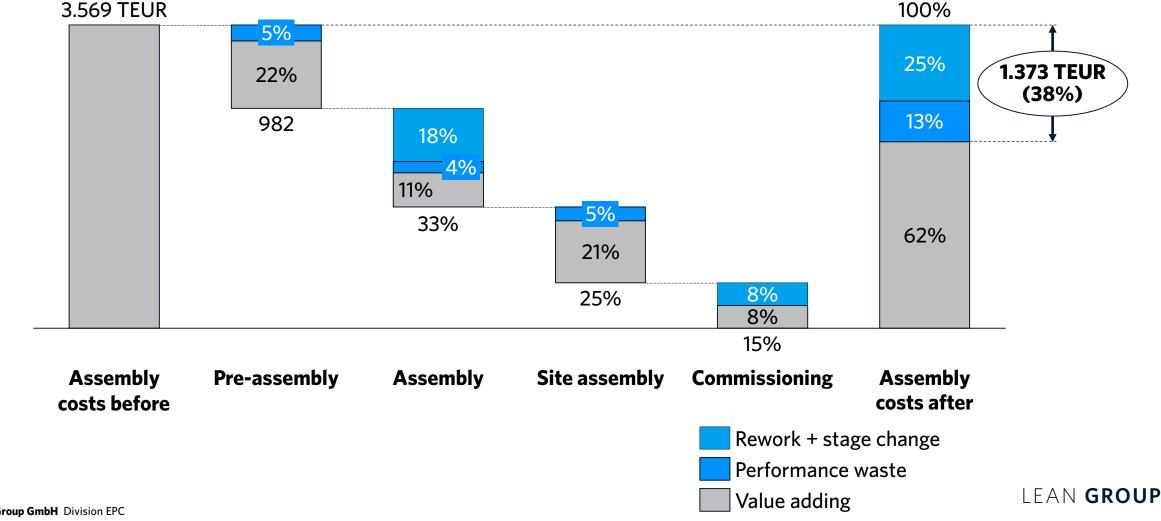
Time to market

- Basic and Detail design acceleration
- Time-to-market reduction
- Change request acceleration

Project Example for supplier optimization

Implemented savings after reorganization of engineering and production

Saving distribution



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